Claims

1. A process for preparing fine metal oxide particles, comprising the following steps of:

a) reacting a reactant mixture comprising i) water, ii) at least one water-soluble metal nitrate and iii) ammonia or ammonium salt at a reaction temperature of 250-700 °C under a reaction pressure of 180-550 bar for 0.01 sec to 10 min in a reaction zone to synthesize the metal oxide particles, the metal nitrate being contained at an amount of 0.01-20 wt% in the reactant mixture; and

b) separating and recovering the metal oxide particles from the resulting reaction products.

2. The process as defined in claim 1, wherein the step a) is carried out by a continuous reactor.

3. The process as defined in claim 2, wherein the continuous reactor is a tube-type reactor.

4. The process as defined in claim 1, wherein the step a) comprises:

providing water subjected to pressurizing and heating;

providing an aqueous solution of the metal nitrate subjected to pressurizing or pressurizing/heating;

providing a fluid containing ammonia or ammonium salt subjected to pressurizing or pressurizing/heating; and

mixing the heated and pressurized water with the aqueous solution of the metal nitrate and the fluid containing ammonia or ammonium salt in a single step or multiple step, followed by reacting the resulting mixture,

wherein, the resulting mixture has a temperature of 250-700 °C and a pressure of 180-550 bar.

5. The process as defined in claim 1, wherein the step a) comprises:

providing an aqueous solution of the metal nitrate subjected to pressurizing and heating;

providing an aqueous ammonia solution or an aqueous ammonium salt solution subjected to pressurizing or pressurizing/heating; and

mixing the aqueous solution of the metal nitrate and the aqueous ammonia solution or an aqueous ammonium salt solution, followed by reacting the resulting mixture,

wherein, the resulting mixture has a temperature of 250-700 °C and a pressure of 180-550 bar.

6. The process as defined in claim 1, wherein the reaction temperature is in the range of 250-550 °C.

7. The process as defined in claim 1, wherein the reaction pressure is in the range of 180-400 bar.

8. The process as defined in claim 1, wherein a metal of the water-soluble metal nitrate is selected from the group consisting of cerium, zinc, cobalt, nickel, copper, iron, aluminum, titanium, barium and manganese.

9. The process as defined in claim 1, wherein the ammonia or ammonium salt is in the form of ammonia gas, an aqueous ammonia solution or an aqueous solution of ammonium salt.

10. The process as defined in claim 4, wherein the fluid containing ammonia or ammonium salt is in the form of ammonia gas, an aqueous ammonia solution or an aqueous solution of ammonium salt.

11. The process as defined in claim 1, wherein the ammonia or ammonium salt

is contained in the reactant mixture at a molar ratio of 0.5-3.0 relative to nitric acid to be converted stoichiometrically from the metal nitrate by the metal oxide synthesis.

12. The process as defined in claim 1, wherein the fine metal oxide particles have a particle size of 1-1000 nm.

13. The process as defined in any one of claims 1-12, further comprising adding an alkali or acidic solution, and/or a reducing agent or oxidizing agent, to the reactant mixture before or during the metal oxide particles synthesis.